LINK TO MSCS EVALUATED SPECIES

The MSCS has identified the following species as potentially benefitting from restoration of nontidal perennial aquatic habitat in the Bay-Delta system.

MSCS SPECIES INCLUDED IN THE ERP

- California red-legged frog
- western pond turtle
- Sacramento perch
- eel-grass pondweed.

OTHER SPECIES EVALUATED IN THE MSCS

- American peregrine falcon
- bald eagle
- Aleutian Canada goose
- California gull.

LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Nontidal perennial aquatic habitat is linked to the following ecosystem elements: (1) ecological processes, (2) habitats, (3) species, and (4) stressors.

Related ecological processes include:

- natural geologic and hydrologic conditions,
- stream meander corridor,
- and tidal actions that maintain permanent water.

Other areas which are closely linked to nontidal perennial aquatic habitat include:

- adjacent wetlands and upland habitats,
- and riparian and riverine aquatic habitat.

Species which depend on nontidal perennial aquatic habitat include:

- resident fish and wildlife,
- migratory birds,
- and plant species and communities.

Stressors which adversely effect nontidal perennial aquatic habitat and wildlife use include:

- levee construction,
- land use,
- loss of edge vegetation,
- and human disturbance.

OBJECTIVE, TARGETS, ACTIONS, AND MEASURES

The Strategic Objective is to restore large expanses of all major habitat types, and sufficient connectivity among habitats, in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay to support recovery and restoration of native species and biotic communities and rehabilitation of ecological processes.

LONG-TERM OBJECTIVE: Restore nontidal perennial aquatic habitat in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay to a substantial fraction of their presettlement areas, or to a point where all at-risk species that depend on the habitats are no longer at risk.

SHORT-TERM OBJECTIVE: Develop and begin implementation of action plans for restoring large and significant examples of nontidal perennial aquatic habitat in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay.

RATIONALE: All major natural habitat types in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay have been reduced to a small fraction of the area they once occupied, resulting in a large number of at-risk plant and animal species and an increased susceptibility of the remaining areas to irreversible degradation (e.g., invasion by non-native species). The reduction trend is continuing and will have to be reversed if self-sustaining examples of these habitats, and the diverse organisms they support, are to persist into the future. This reversal will require a large number of diverse and localized actions, from levee setbacks to land acquisition to better management of existing sites. The major habitat types to be restored include tidal shallow water habitat, freshwater emergent wetland, channel islands and associated habitats, tidal sloughs, nontidal freshwater emergent wetlands, seasonal upland wetlands, vernal pools and surrounding uplands, riparian forests and associated upland areas, perennial grassland, and inland dune scrub. In order to make restoration actions systematic and cost-effective, specific objectives need to be

and cost-effective, specific objectives need to be established for each of the habitat types, as well as subsets of them that have distinctive biological characteristics, and then priorities set within each objective for protection and restoration activities.

STAGE 1 EXPECTATIONS: A classification system for Delta, Suisun Bay, Suisun Marsh, and San Pablo Bay habitats that can be used as a basis for conservation actions will have been developed. Specific, numeric objectives should be formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Within and among habitat types, conservation and restoration activities should be prioritized. Work should begin on those projects given highest priority within a year of adoption of the strategic plan.

RESTORATION ACTIONS

The general target for restoring nontidal perennial aquatic habitat is to provide 2,600 acres in the Sacramento-San Joaquin Delta Ecological Management Zone, 1,600 acres in the Suisun Marsh/North San Francisco Bay Ecological Management Zone, and 1,000 acres in the West San Joaquin Ecological Management Zone.

The following actions would help to achieve targets for nontidal perennial aquatic habitat restoration:

- Restore nontidal perennial aquatic habitat in concert with restoration of fresh emergent wetland habitats.
- Restore permanent open-water areas by establishing elevation gradients sufficient to maintain surface water through natural groundwater or surface-water recharge, or by pumping water into lowland areas.

MSCS CONSERVATION MEASURES

The Multi-Species Conservation Strategy (2000) has developed draft recommendations identifying the types of potential conservation measures to protect non-tidal perennial aquatic habitat dependent species.

- Avoid implementing actions that would result in the loss or degradation of traditional wintering habitat use area (Aleutian Canada goose).
- Enhance or restore 1 to 2 acres of suitable natural or agricultural habitat to replace every acre of traditional wintering habitat use areas that are permanently lost or degraded as a result of implementing ERP actions (Aleutian Canada goose).
- To the extent consistent with overall ERP objectives, direct proposed actions for improving agricultural habitats for wildlife to protecting and improving traditional wintering habitat use areas (Aleutian Canada goose).
- Program actions that potentially could mobilize large quantities of toxic materials from the soil should include an analysis to determine the amount of contaminants that could be mobilized and, if released contaminant loadings could be harmful, modify actions to reduce loadings of mobilized contaminants (American peregrine falcon).
- Conduct surveys in suitable habitat areas within the species range that could be affected by ERP actions to determine the presence and distribution of the western pond turtle before implementing actions that could result in the loss or degradation of occupied habitat (western pond turtle, California red-legged frog, eel-grass pondweed).
- Avoid implementing ERP actions that could result in the substantial loss or degradation of suitable habitat in areas that support core species' populations that are essential to maintaining the viability and distribution of the species (western pond turtle, California red-legged frog, eel-grass pondweed).
- If occupied habitat would be affected by ERP actions: 1) acquire, protect and mange existing occupied habitat areas or 2) enhance or restore 1 to 3 acres of suitable habitat for every acre of occupied habitat affected by ERP actions near where impacts are incurred (western pond turtle, California red-legged frog).
- If occupied habitat would be affected by ERP actions, to the extent feasible, capture individuals from the affected area and relocate to nearby suitable existing, restored, or enhanced areas (western pond turtle).

- If occupied habitat would be affected by ERP actions, to the extent feasible, capture individuals from the affected area and relocate to nearby suitable existing, restored, or enhanced areas that do not support non-native predator populations (California red-legged frog).
- Manage lands purchased or acquired under conservation easements that are occupied by the species to maintain or increase their current population levels (western pond turtle, eel-grass pondweed).
- Coordinate protection, enhancement, and restoration of the Sacramento perch and its habitats with other federal, state, and regional programs (e.g., USFWS recovery plans) that could affect management of current and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives (Sacramento perch).
- Implement reintroductions into suitable habitat areas and manage habitat areas to maintain introduced populations (Sacramento perch).

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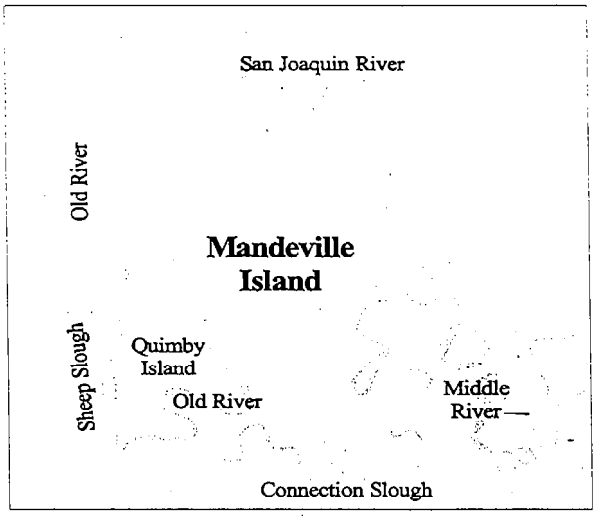
◆ DELTA SLOUGHS



INTRODUCTION

Sloughs are a small remaining part of natural Delta habitats. Sloughs are tidal channels of the Delta that once connected rivers to the Bay through Delta marshes. These low-velocity, natural tributaries of Delta rivers vary in depth and width, have gently sloped, vegetated sides, and are connected to the Delta.

Most of the Delta sloughs were lost when the islands were reclaimed by construction of the levees. Many smaller Delta sloughs were lost in the past several decades when levees severed them from main channels. Levee construction and maintenance along sloughs has reduced the habitat value of many natural sloughs in the Delta. Boat traffic has also lead to shoreline erosion and loss of shallow water, marsh, and riparian habitat along many sloughs.

Sloughs provide warmer, highly productive habitat for seasonal spawning, rearing, and foraging for many aquatic organisms, as well as important organic carbon productivity for all habitats of the Bay-Delta. Sloughs provide shallow, low-velocity refuge habitat for many native fishes. Slough habitat also includes associated marsh and riparian corridors that are important for breeding, feeding, resting, and roosting waterfowl. Several resident species of Delta fish live in sloughs, and splittail and delta smelt may use them for spawning. Unlike leveed river channels, sloughs have marsh and riparian fringes with shallow water and natural shaded riverine aquatic habitat.

RESOURCE DESCRIPTION

Delta sloughs provide various beneficial habitats. They offer protection to plants, fish, and wildlife from wind and high-velocity flows. Delta sloughs support floating aquatic plant communities, which are otherwise found only in small, sheltered pockets along open channels. The seasonal succession of native floating plants in sloughs is a valuable link in the estuary's food chain. First to appear is duckweed, which provides primary food production for insect larvae, crustaceans, and waterfowl and other birds. The duckweed community creates conditions favorable to water fern establishment. The water fern's pores contain a bacterium that photosynthesizes and "fixes" (stores) nitrogen, which allows the water ferns to establish in nitrogen-deficient waters. Aquatic plants in sloughs provide protective cover for fish; habitats for insects, fish, and birds; and an abundance of food organisms. Wildlife use varies with the amount of open water and marsh, the extent and type of vegetation present, and surrounding land uses.

Delta sloughs provide habitat for biological functions necessary for the survival of resident and migratory fish species. These species need warm, highly productive Delta sloughs habitat for seasonal spawning, rearing, and foraging. Organic carbon created by the sloughs helps other Bay-Delta habitats.

Adjacent marsh and riparian corridors provide breeding, feeding, resting, and roosting habitat for waterfowl and wildlife. Delta sloughs and their riparian scrub, riparian forest, and open-water habitats provide the complex habitat needed by some State- and federally listed species such as the giant garter snake, splittail, and delta smelt.

DELTA SLOUGHS are defined in the MSCS as a component of tidal perennial aquatic habitat that includes deepwater slough areas (greater than 3 meters deep from mean low low tide) and shallow slough areas (less that or equal to 3 meters deep from mean low low tide) Multi-Species Conservation Strategy 2000).

Dead-end sloughs include Beaver, Hog, and Sycamore sloughs. These quiet backwaters provide essential habitat for native resident fish. Open-ended sloughs provide unique, generally low-velocity habitats and migratory pathways for many species. In addition, the adjacent riparian corridors provide habitat for wildlife and waterfowl.

Sloughs provide valuable transitional zones that link upland terrestrial habitats with open-water habitats. Historically, these transitional areas provided foraging, resting, and escape cover for shore and wading birds and other waterfowl. Resident and migratory fish use sloughs for rearing, foraging, and escape cover.

The ability of most sloughs to provide these functions has been severely degraded. Urban and industrial development has moved into areas adjacent to sloughs, destroying historic riparian habitat. Other factors that have contributed to degradation of habitat values include invasion and spread of non-native aquatic plants, such as water hyacinth, reduced water quality, and reduced freshwater outflows. In addition, levee construction and channel dredging have converted gradual sideslopes that once supported marsh and tidal flat habitat into steep-sided, high-velocity channels with narrow strips of emergent shoreline habitat.

VISION

The vision for Delta sloughs is to increase the area and improve the quality of interconnected dead-end and open-ended Delta sloughs to assist in the recovery of special-status fish and wildlife populations, provide shallow-water habitats for fish spawning and rearing, and provide aquatic, wetland, and riparian habitat for wildlife.

Existing natural sloughs require protection and habitat improvement. Additional restoration efforts would be identified by developing a thorough understanding of site-specific sediment transport, tides, hydrogeomorphology (landscape forms created by moving water), and Delta channel hydraulics (water flow patterns). Restoration of a variety of slough and adjacent terrestrial and aquatic areas would provide a wide range of complex habitats that would benefit many aquatic and terrestrial species.

Changes in tidal flows through sloughs and decreased human disturbance, e.g., reduced wake erosion, could improve slough habitats. Removing invasive, non-native aquatic plants would help restore many smaller sloughs to their natural function.

LINK TO MSCS EVALUATED SPECIES

The MSCS has identified the following species as potentially benefitting from restoration of Delta sloughs as a component of tidal perennial aquatic habitat in the Bay-Delta system.

- California least tern
- western snowy plover
- American peregrine falcon
- bald eagle
- Aleutian Canada goose
- California brown pelican
- steelhead
- delta smelt
- winter-run chinook salmon
- tidewater goby
- California freshwater shrimp
- Sacramento splittail
- fall-run chinook salmon
- spring-run chinook salmon
- California gull
- long-billed curlew
- osprey
- Sacramento perch
- longfin smelt and
- green sturgeon.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

Delta sloughs as described here are related to the tidal riverine classification in Cowardin (1979), the

slough and backwater designation in Moyle and Ellison (1991), and the channels and open water habitat and lakes and dead-end channels descriptions in Madrone Associates (1980).

Many projects associated with wetlands would benefit open-ended and dead-end sloughs. Some of these are sponsored by:

- San Francisco Estuary Project, Bay Area Wetlands Planning Group,
- California Wetland Riparian Geographic Information System Project,
- Governor's California Wetland Conservation Policy,
- Canal Ranch Project to develop tidally influenced areas and riparian zones in conjunction with existing agricultural practices,
- Inland Wetlands Conservation Program,
- North Bay Wetlands Protection Program,
- San Francisco Estuary Project,
- and Wetlands Reserve Program.

Linkage with Other Ecosystem Elements

Delta sloughs are linked to the following ecosystem elements: (1) ecological processes, (2) habitats, (3) species, and (4) stressors. For example sloughs are an important element in Delta channel hydraulics, provide a range of aquatic habitats from deep water to tidal emergent vegetation, and support riparian vegetation. Many resident fish species, invertebrates, reptiles, and amphibians utilize these habitats, as well as resident and neotropical migratory birds, and waterfowl.

Maintenance and restoration of Delta and other tidal slough are dependent on channel hydraulics, natural sediment supply, sediment transport, erosion, deposition, and tides.

Other habitats that are interconnected to Delta and other tidal sloughs include open water areas, tidal perennial aquatic habitat, mainstem rivers, emergent wetlands, mudflats, seasonal floodplains, and riparian and riverine aquatic habitats.

Stressors to the health and quality of slough habitats include levee and channel island erosion, increased water velocities, and the removal of overhanging vegetation.

Objective, Targets, Actions, and Measures

The Strategic Objective is to restore large expanses of all major habitat types, and sufficient connectivity among habitats, in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay to support recovery and restoration of native species and biotic communities and rehabilitation of ecological processes.

Long-Term Objective: Restore slough habitats in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay to a substantial fraction of their pre-settlement areas, or to a point where all at-risk species that depend on the habitats are no longer at risk.

Short-Term Objective: Develop and begin implementation of action plans for restoring large and significant examples of slough habitat in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay.

Rationale: All major natural habitat types in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay have been reduced to a small fraction of the area they once occupied, resulting in a large number of at-risk plant and animal species and an increased susceptibility of the remaining areas to irreversible degradation (e.g., invasion by non-native species). The reduction trend is continuing and will have to be reversed if self-sustaining examples of these habitats, and the diverse organisms they support, are to persist into the future. This reversal will require a large number of diverse and localized actions, from levee setbacks to land acquisition to better management of existing sites. The major habitat types to be restored include tidal shallow water habitat, freshwater emergent wetland, channel islands and associated habitats, tidal sloughs, nontidal freshwater emergent wetlands, seasonal upland wetlands, vernal pools and surrounding uplands, riparian forests and associated upland areas, perennial grassland, and inland dune

scrub. In order to make restoration actions systematic and cost-effective, specific objectives need to be established for each of the habitat types, as well as subsets of them that have distinctive biological characteristics, and then priorities set within each objective for protection and restoration activities.

STAGE 1 EXPECTATIONS: A classification system for Delta, Suisun Bay, Suisun Marsh, and San Pablo Bay habitats that can be used as a basis for conservation actions will have been developed. Specific, numeric objectives should be formulated for each habitat type, with restoration objectives based on clearly stated conceptual models. Within and among habitat types, conservation and restoration activities should be prioritized. Work should begin on those projects given highest priority within a year of adoption of the strategic plan.

RESTORATION ACTIONS

The general target for restoration of Delta sloughs it to restore 160 miles in the Sacramento-San Joaquin Delta Ecological Management Zone and 30 miles of tidal sloughs in the Suisun Marsh/North San Francisco Bay Ecological Management Zone. The restoration of Delta sloughs will, in many instances, be closely linked to the restoration of tidal perennial habitat, and fresh and saline emergent marshes. In developing the approach to habitat restoration, a mosaic of habitats is very desirable, including provisions for increasing the overall linear mileage of Delta sloughs.

Actions that could be taken to improve slough habitat in the Delta include the following:

- Protect existing dead-end and open-ended sloughs from possible future degradation through cooperative agreements with land management agencies or conservation easements or purchase from willing sellers.
- Restore hydrologic conditions necessary for establishing Delta sloughs by constructing setback levees, removing dikes, constricting slough openings, and managing flows through Delta channels.
- Where consistent with flood control objectives, modify vegetation management practices along levees adjacent to sloughs to allow wetland vegetation to reestablish naturally.
- Identify and implement solutions to levee and channel island erosion that do not remove shallow-water habitat, increase water velocities, or remove overhanging vegetation.
- Reduce the adverse effects of boat wakes in sensitive habitat areas by excluding boats from certain areas at certain times and establishing maximum speed limits.
- Restore connectivity between high-quality habitats through cooperative agreements with land management agencies or through conservation easements or purchase from willing sellers.
- Where possible create new slough habitat where tidal saline and freshwater emergent wetlands are created in the Bay and Delta.

MSCS CONSERVATION MEASURE

The following conservation measure was included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions that would help achieve species habitat or population targets.

- To the extent practicable, direct ERP salt marsh enhancement efforts toward existing degraded marshes that are of sufficient size and configuration to develop fourth order tidal channels (marshes would likely need to be at least 1,000 acres in size).

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◆ MIDCHANNEL ISLANDS AND SHOALS

INTRODUCTION

Midchannel islands and shoals provide unique remnant shallow-water habitats in many Delta channels. They typically support tule marsh, and to a lesser extent willow scrub, tidal mudflat habitats and associated wildlife and fish. Some midchannel islands have small, remaining riparian woodlands with oaks, cottonwoods, alders, and willows.

Midchannel islands and shoals have been shrinking or disappearing from progressive erosion of the remaining habitat. Loss of islands and shoals affects fish and wildlife habitats, and foodweb productivity. Major factors contributing to the loss of midchannel islands and shoals are gradual erosion from channels conveying water across the Delta to south Delta pumping plants, boat wakes, and dredging within the Delta or on adjacent waters.

MIDCHANNEL ISLANDS AND SHOALS are defined in the MSCS as a component of both tidal perennial aquatic and tidal freshwater emergent habitats. Tidal perennial aquatic habitat is defined as deepwater aquatic (greater than 3 meters deep from mean low low tide), shallow aquatic (less than or equal to 3 meters deep from mean low low tide), and unvegetated intertidal zone of estuarine bays, river channels and slough. Tidal freshwater emergent habitat includes portions of the intertidal zones of the Delta that support emergent wetland plant species that are not tolerant of saline or brackish conditions (Multi-Species Conservation Strategy 2000).

RESOURCE DESCRIPTION

Midchannel islands and adjacent shoals provide shallow-water edge, riparian scrub, and emergent marsh habitats in selected Delta channels. The midchannel islands in some Delta locations retain many of these qualities because of their relative isolation. In other channels, high water velocities, heavy use for boating, and associated wave-induced erosion have degraded these islands. Many Delta channels and their midchannel islands and shoals are changing rapidly because of increased wakes from boats and changes in water velocities.

Midchannel islands vary in size, shape, and elevation, creating a diversity of habitat types and associated wildlife benefits. Protecting midchannel islands and shoals will help improve the overall quality and diversity of Bay-Delta aquatic habitats. Improving the productivity of the Bay-Delta aquatic habitat foodweb is needed to support the sustainable production and survival of fish.

The Delta formerly supported broad expanses of tule marshes, riparian forests, and shallow-water habitats. Today, intensive agricultural production on levee-bounded islands has replaced most of these habitats. Delta islands are separated by steep-banked waterways, which provide few shallow-water areas where natural vegetation can take root. Natural vegetation is generally limited to midchannel islands and a narrow band along levee edges. In many areas, even this remaining band of vegetation has been displaced by bank protection. Cumulative loss of natural vegetation has a detrimental impact on the Delta's fish and wildlife populations.

Midchannel islands and shoals in the Delta are the remnants of naturally occurring islands that existed prior to reclamation or are remnants of natural or old levees. The islands are the surviving examples of an expansive tule marsh with largely shallow and diffuse channels separating the stands. Early efforts to convert the Delta islands into agricultural lands included dredging near these islands for material to form levees. At first, dredging was simple because most of the excavated land was intertidal marsh. While converting the marsh to agriculture lands, naturally meandering channels were straightened, resulting in the creation of tule islands. In other areas, the distance between levees was wide and marsh was left between the levees. The sizes of these remainders varied considerably.

Midchannel islands and their adjacent shoals present a wide array of physiographic types and include a variety of habitats. Island habitats range from small tule islands that are essentially freshwater marshlands to large upland sites with riparian woodland, dredge spoils, brushland, ponds, and a variety of marsh types.

An important attribute of these islands is their isolation from mainland activities. Isolation turns these islands into wildlife refuges during spring and summer months when recreational use of the Delta is at its peak.

Midchannel islands and shoals provide valuable riverine-edge and shallow-water habitat within main channels. Actual descriptions of midchannel islands would have to be made on a site-by-site basis, since their physical features depend on parameters such as elevation, size, location, and amount of human disturbance. The island's isolation from human disturbance and the amount of disturbance to the terrestrial-aquatic interface determine the value of midchannel islands to wildlife, especially listed species.

Midchannel islands and shoals are important components of the landscape and contribute to the health of the Bay-Delta. Other important ecological functions influencing Bay-Delta health include natural sediment supply, aquatic habitat, nutrient input, and areas of primary and secondary production. Various life stages and species of fish require a variety of habitats and the ability to move between habitat patches. Habitat variations and access are important for the reproduction and survival of fish in flowing water ecosystems. Shallow water habitat in the Delta is predominantly found along levees, islands, and shoals. The terrestrial-aquatic interface provides habitat diversity, a large supply of organic matter, and shallow habitats with few aquatic predators. Most Delta-spawning fish spawn in shallow water.

Human activities on stream ecosystems typically concentrated at the terrestrial-aquatic interface. Shallow water land uses decrease the diversity and connectivity of physical habitats. The result of these alterations is a reduction in fish diversity, a shift in fish trophic structure, and an increase in temporal variability of fish abundance in water ecosystems.

The terrestrial-aquatic interface experiences extreme physical-chemical variability when hydraulic conditions fluctuate. Floodflows are confined by levees and bank protection structures. Fluvial energy increases flows that scour and cut into the midchannel islands and shoals.

The main concern regarding midchannel islands is the rate at which they are eroding. Midchannel islands are built up by sediment deposition and reduced by erosion. Reduction of flow or sediments reduces or halts the rate of midchannel island formation. Some waterways within the Delta lack sufficient sediment, while in other areas, erosion exceeds deposition. Lack of sediment supply to the Delta causes midchannel islands and shoals to erode, decreasing both the quality and quantity of island and shoal habitat. Dredging the shoals immediately adjacent to channel islands undermines the structural stability of the islands and subjects them to slumping and increased erosion. Boat wakes and boat-related recreational activities play a large role in the increased rate of erosion.

VISION

The vision for mid-channel islands and shoals is to increase and enhance the area and protect the quality of existing habitat for fish and wildlife dependent on the Bay-Delta.

Restoring midchannel islands is dependent on local hydrologic conditions (e.g., water depth, water velocity, and wave action). Depositing sediment necessary for establishing and maintaining shoals and terrestrial-aquatic interfaces will help rebuild the islands and reduce harmful erosion. Preserving midchannel island isolation will protect the islands and shoals from further damage and allow for natural habitat restoration.

Direct restoration of midchannel islands and shoals will be the primary approach to achieving this vision. The primary method of restoring midchannel islands would be to protect and improve existing channel islands. Restoration should include reconstructing the natural flows and velocities that provided consistent and predictable flows and sediments. Consequently, sediment supply must be restored to that which formed islands, shoals, and habitat for native fish and wildlife.

Reducing erosion rates and offsetting erosion losses would reduce the effects of major stressors on these islands. Reducing boat wakes and excessive channel velocities will allow deposits and wetlands to establish.

LINK TO MSCS EVALUATED SPECIES

The MSCS has identified the following species as potentially benefitting from restoration of tidal perennial aquatic habitat in the Bay-Delta system:

MSCS SPECIES INCLUDED IN THE ERP

- steelhead
- delta smelt
- winter-run chinook salmon
- Sacramento splittail
- fall-run chinook salmon
- spring-run chinook salmon
- Sacramento perch
- longfin smelt
- green sturgeon
- California freshwater shrimp.

OTHER SPECIES EVALUATED IN THE MSCS

- California least tern
- western snowy plover
- American peregrine falcon
- bald eagle
- Aleutian Canada goose
- California brown pelican
- tidewater goby
- California gull
- long-billed curlew
- osprey.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

Midchannel islands as described here is very similar to the channel island designation in Madrone Associates (1980).

The U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service Deep Water Ship Channel Monitoring Program provided information to successfully design and create wetland habitats in the Delta. The project deposited dredged spoils to create new shallow-water, wetland, and upland habitats within two flooded islands in the Sacramento-San Joaquin Delta. The Levee Subvention Program demonstration projects for erosion control and habitat establishment is another related effort.

The San Francisco Estuary Project's Delta In-Channel Island Work Group has reviewed and researched a number of candidate islands for restoration and investigated available biotechnical techniques for erosion control, land restoration, and revegetation. The Group is presently funded to conduct demonstration restoration projects on Little Tinsley and Webb Tract islands.

LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Midchannel islands and shoals are linked to other ecosystem elements including ecological processes, habitat, species, and stressors.

Ecological processes include contribution to the Bay-Delta aquatic foodweb and natural sediment supply which helps to maintain channel islands.

Midchannel islands and shoals provide riverine-edge habitat, shallow-water habitat, escape cover for young fish and wildlife, riparian and riverine aquatic habitat, and mudflats. Numerous aquatic and terrestrial fish, wildlife, and plant species rely on the complex array of habitats provided by this type of habitat.

Erosion seems to be the major stressor that is impairing the ecological health of this resource. This erosion is a result of wind-driven and boat wake wave erosion and high channel water velocities.

OBJECTIVES, TARGETS, ACTIONS, AND MEASURES

Midchannel islands and shoals are addressed by two Strategic Objectives. One objective addresses habitat and the other addresses the physical processes necessary to maintain channel islands.

The Strategic Objective is to restore large expanses of all major habitat types, and sufficient connectivity among habitats, in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay to support recovery and restoration of native species and biotic communities and rehabilitation of ecological processes.